Detection of phenological occurrence dates from space with Sentinel-2 and MODIS

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This study aims at establishing a relationship between satellite-based land surface phenology (LSP) and ground phenology (GP) such that phenological occurrence dates can be determined from space. Therefore we use the Normalized Difference Vegetation Index (NDVI that describes photosynthetic activity of the Earth's vegetation) inferred from Sentinel-2 data and apply various approaches based on its development. These approaches are subsequently validated and compared amongst each other in order to identify the most suitable formulation.

Here, we focus on the leaf shoots of birch and beech since the European phenological database PEP725 contains a large number of pertaining observations. The beech is a dominant tree species in Central European deciduous forests, whereas pure birch forests are restricted to Scandinavian countries. In Austria, birches begin to sprout first leaves in about mid-March whilst in Sweden this phase occurs approximately two months later. Throughout the bygone half-century occurrence dates of beech- and birch-leaf-unfolding show shifts towards earlier Julian days of about one and a half week in Central Europe.

The analysis carried out is based (i) on the 2016, 2017 (and perhaps 2018) spring phases for Tyrol and southern Germany and (ii) on the 2017 (2018) spring phase(s) for Upper and Lower Austria. Aside from Sentinel-2 we use satellite data from MODIS too. These data have a spatial resolution of 250m and a temporal resolution of about 5 days. Results show (i) how well Sentinel-2 data, which have a spatial-temporal resolution of 10m and 10 days, determine occurrence dates of birch- and beech-leaf-unfolding as well as (ii) how much findings improve by using Sentinel-2 data instead of MODIS.